The effect of Bean type and mass on the reproduction of *Callosobruchus maculatus*

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Undergraduate Research Experience in Entomology

K-State 2025 K-STATE Research and Extension

Abstract

This research project is involved in the ecological aspect of resource partitioning. This is important in the reproductive capacity of the bean beetle. (Mitchell, 1975). In order to test this reproductive capacity, an experiment with the host beans has been set up. The question is whether the reproductive capacity is more affected by the type or amount of beans. Since adults do not require food, eggs were counted after the adults died. (Blumer and Beck, 2018). It was found that the adults preferred the mung beans. There was also no relevance between mass and the amount of eggs. These ecological findings show that it is not necessarily the mass of the beans that matters. It is in fact the type that the beetle prefers. (Gerson and Applebaum, 2014).

Purpose

The purpose of this research is to study the effect bean type and availability had on the reproductive output of the bean beetles with the wider vision of resource partitioning in an ecological system.

Questions, Hypotheses, and Predictions

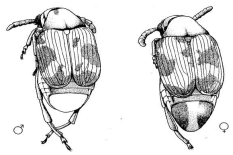
Question: Is the reproduction affected more by the type or amount of beans?

Hypothesis: The beetles will have a preference for the larger blackeye beans, rather than the smaller mung beans because they have more area to partition between the lot.

Prediction: There will be a general increase as bean number goes up, but the beetles will perform better with the Blackeye beans.

Study System

The bean bettle, *Callosobruchus maculatus*, is naturally a pest insect found in Africa and Asia. The larvae feed on legumes. Adults do not consume food or water in their two week life span. Eggs are laid on the beans and the larvae hatch, bore into the bean, and emerge as adults within two to three weeks. All in all, the generation time is about four weeks.



Methods and Experimental Design

Two types of beans were used. Mung beans and black-eye beans. There were two different variables tested. The first was bean type, the second was the total mass of beans. I used square petri dishes that were sealed using a semipermeable tape that allowed air to pass through. There were three different mass sizes with three different mixes of beans. So for each of the three replicates, there were nine dishes. The total number of dishes was twenty-seven. To make the masses standardized, I used a scale to measure out the masses. Each dish had 1, 1.5, or 2 grams of beans. Each of the dishes also had Mung, Blackeye, or both beans. Once the beans were portioned out, I placed two male and two female beetles in each dish. They were left to lay eggs for 2 weeks. After that time I counted the eggs and recorded the data. I analyzed the data using regression and ANOVA.

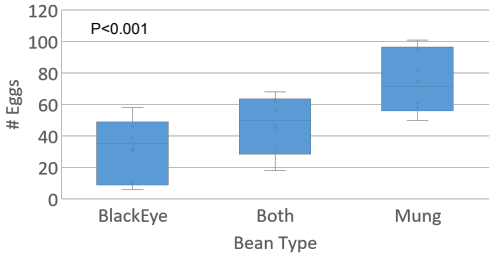


Figure 1. Effect of bean type on number of eggs laid

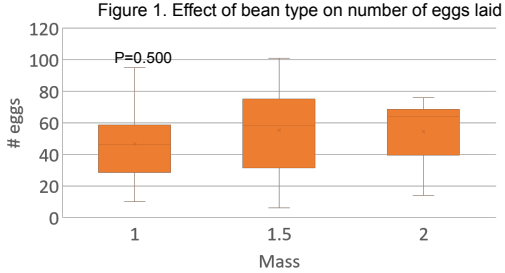


Figure 2. Effect of bean mass on number of eggs laid

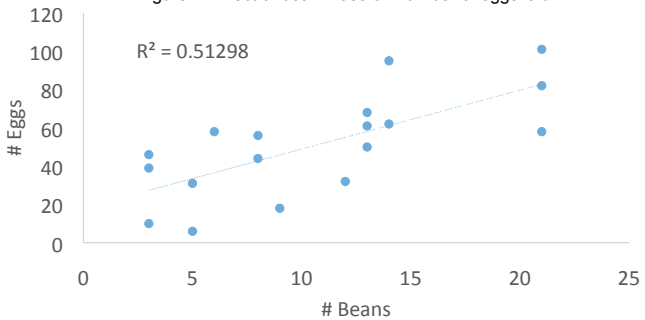


Figure 3. Effect of number of beans on eggs laid

Results

The beetles preferred the Mung beans by far as compared to the blackeye beans with dishes containing both beans lying somewhere in the middle. There was significant difference with the bean types. (Fig. 1)

As mass increased, in general the eggs increased without significant difference. (Fig. 2)

In figure 3, the number of beans appears to be directly related to the number of eggs.

Conclusions

The data showed that the beetles preferred the mung beans. Therefore, my hypothesis was proved wrong. For some reason, they disliked the blackeye beans, possibly because of thick shell, smell, or color. As I expected as mass increased, the eggs increased. However it was not significantly different.

Future Directions

Seeing that the beetles had a preference for mung beans, I would conduct research finding out the reason. I could isolate certain aspects of the beans to see what about the mung beans attracts the beetles. Another thing is to try other kinds of beans as well. Since I am tying this into ecological concepts, maybe I could find a natural predator for these beetles, and conduct an experiment with this.

References

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Acknowledgements

Thanks to Dr. Tania Kim for allowing me to use her lab space as well as supplies and equipment.

Thanks to Dr. Jeremy Marshall for bringing this amazing opportunity to my attention in the first place.

And of course thanks to Dr. Brian Spiesman for his mentorship with the project and advise on my poster.